Technology Innovation Project

Project Brief

TIP 285: Energy Storage Multifaceted Tool for Demand Management

Context

Energy storage can provide a number of benefits to utilities by increasing flexibility of the grid system. In the Pacific Northwest, a total of 6000 MW of wind power capacity is forecasted to be installed by the end of 2013. The need to manage variability and intermittency of renewable energy resources has become a very real challenge, sometimes requiring curtailments to sustain reliable grid operations.

Energy storage systems have the potential to solve many challenges associated with grid operations. These technologies show promise, but it remains difficult to quantify their benefits. What makes energy storage even more compelling is that one system can, in theory, serve multiple applications. Storage, through the ability to act as both "load and generation," can work within the BPA region to provide a number of important services:

- Peak load reduction: Storage can be dispatched to reduce the need for additional peaking generation, transmission and distribution investment.
- Provision of balancing services: Storage can react very rapidly to signals from the utility to charge or discharge as required to match supply and demand.
- Provision of spinning reserves: Storage can respond almost instantaneously to help stabilize frequency fluctuations caused by line and generator trips much more effectively than can rotary generation equipment.
- Reduce minimum load conditions: Unlike traditional generation, storage can withdraw surplus grid energy, allowing system operators to use assets more efficiently.

Description

This project intends to demonstrate and quantify the value of an electric energy storage system placed close to an end user, where the expected value is high, to provide service similar to demand response but without need for behavioral change or impact on end users. The project has three phases:

- Analyze the value of storage systems in a Puget Sound Energy (PSE) distribution system
- Install a storage system
- Manage the ability of the installed storage system to optimize overall system operations

Energy storage technologies have made significant strides that have altered their performance capabilities and cost/benefit analysis. Primus Power is developing a zinc-based flow battery technology for stationary energy storage. Primus Power's EnergyCells are packaged into an EnergyPod – a containerized energy storage system for utilities, renewable energy developers, companies and campuses. The EnergyPod has a power rating of 250 kW and a discharge time of 4 hrs at maximum power. They offer the same traditional value streams as pumped storage, but with tremendous flexibility to be installed into the distribution grid, in targeted incremental investments and at specific choke points.

Why It Matters

Energy storage can act as a truly controllable and reliable form of demand management, complementing other forms of direct interaction with load. Storage does not inconvenience the end-use customer, it is fully dispatchable, it is instantaneous, and it can increase load over several consecutive hours, which can be difficult with some load management techniques. Distributed energy storage allows the utility to capture a wider array of services with a single system. When located in the distribution grid, it can also help defer investment in both transmission and distribution infrastructure and to manage power flows to alleviate congestion, increasing use and cost-effectiveness of assets. Located near the load, it can help manage local voltage and VAR, helping to improve power quality and reliability. Energy storage has the potential to address many significant BPA challenges:

- Power system stability control, through the provision of balancing services, spinning reserves, frequency response and voltage/VAR support
- Congestion management through placement at key points in the grid to facilitate power flows
- Integration of renewable energy resources through provision of balancing services at minimum load condition
- Changing load characteristics

Goals and Objectives

- Analyze multiple values of distributed storage to the Pacific Northwest power grid
- Select a location for a pilot to capture as many different value streams as possible
- Develop control strategies that maximize the total value of the storage.
- Demonstrate a 500-kW, 1-MWh storage system
- Analyze the operation, test control algorithms and validate performance and effectiveness

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Project Start Date: October 1, 2012

Project End Date: September 18, 2015

Reports & References (Optional)

Links (Optional)

Funding

Total Project Cost:	$ 2,866,717
BPA Share:	$ 980,707
External Share:	$ 1,886,010
BPA FY2015 Budget:	$ 181,871

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Participating Organizations

Puget Sound Energy
Department of Energy, Office of Electricity
Primus Power